

Construction Activity in the 1958 Input-Output Study

THIS is the second in a series of articles on the 1958 input-output study. The first article, which appeared in the November 1964 *SURVEY OF CURRENT BUSINESS*, presented the concepts, uses, and basic data of the study. Succeeding articles, such as this one on construction, will examine special aspects of the study more intensively.

The first part of this article is a presentation of data showing the industrial origin of materials and services used in several individual types of new construction and of maintenance and repair construction—for example, housing, schools, utilities, and highways. It may be recalled that the earlier input-output article provided data for only two broad categories of construction: total new and total maintenance and repair construction. The second part is an examination of the change from 1947 to 1958¹ in the materials and services used in new and maintenance and repair construction. Three components of change are analyzed: shifts in the relative importance of individual types of construction, differential price movements of goods and services, and a residual category of all other factors. Definitions and sources of the construction statistics are given in the appendix.

Treatment of construction in the 1958 input-output table

The 1958 input-output table represents the flows of goods and services among the individual industries of the economy and to final users on a basis that is conceptually and statistically

consistent with the national income and product accounts. Each industry is presented in the table as a column and a row. Reading down the column, one may see an industry's consumption of goods and services from the various industries and its value added (compensation of employees, proprietors' income, corporate profits, net interest, capital consumption allowances, and indirect business taxes). Reading across the row shows the distribution of an industry's output to the various industries and to final demand (personal consumption expenditures, gross private fixed capital formation, net inventory change, Government purchases of goods and services, and gross exports). Since the sum of an industry's inputs (goods and services consumed and value added) is equivalent to the sum of its outputs, the total of the column equals the total of the row for each industry.

The measures of new and maintenance and repair construction covered in this article comprise all expenditures for construction, private and public, in the economy. They include all construction activity regardless of who performed the work. Thus, construction work done by contractors, by employees of Government agencies and nonconstruction firms, and by households on a do-it-yourself basis are all included.

The value of all new construction is distributed exclusively to final markets. New private construction is included in gross private fixed capital formation, and new public construction is a component of Government purchases.

Maintenance and repair construction is, on the other hand, treated mainly like any other business expense required for current production. Consequently, maintenance and repair construction is represented as distributing its output

primarily to the various industries including Government enterprises. However, maintenance and repair construction performed or contracted by general Government is shown as Government purchases and is thus a component of final demand.²

Importance of construction in the economy

The importance of construction is well known. In 1964 the total value of new and maintenance and repair construction was \$89 billion. New construction accounted for \$89 billion or 11 percent of the gross national product.

Since 1950, new construction, in current and constant dollars, has risen at approximately the same rate as the gross national product, while maintenance and repair construction has expanded at a somewhat lower rate. In 1964, the private share of total new construction was 71 percent, a proportion that has remained relatively constant since the early 1950's. Private expenditures accounted for the major part of total maintenance and repair construction in 1964.³

The number of persons engaged in all construction activity in 1964 was approximately 5 million. Of this total, 3.1 million were in the contract con-

¹ In the national accounts framework, Government enterprises comprise the public functions that cover over half of their current operating costs by the sale of goods and services to the general public, and Government purchases refer to general Government operations that are financed by general revenues. Therefore, public maintenance and repair construction for sewer and water facilities and for highway toll roads is allocated to Government enterprises, while that for military facilities and freeways is allocated to general Government.

² Because of statistical limitations, trends in the private and public components of maintenance and repair construction cannot be determined. The 1964 level of maintenance and repair construction had to be estimated for this article since 1961 is the latest year for which data have been published. (See *Construction Review*, U.S. Department of Commerce, October 1963.) It should be noted that a significant part of the value of maintenance and repair construction is estimated by means of a variety of procedures that are quite indirect.

³ The 1947 inputs for construction are derived from the 1947 input-output study prepared by the Bureau of Labor Statistics of the U.S. Department of Labor. David I. Slack, currently with the Bureau of the Census, developed the estimates of the goods and services used in construction for the 1947 study.

NOTE.—Elizabeth G. Rhodes carried out the statistical computations necessary for estimating the goods and services used in construction.

struction industry.⁴ In recent years, employment in contract construction has been just under 3 million; 1964 was the first year it exceeded this level. This recent strength in employment has reflected an expansion in the volume of

construction activity. The rise has more than offset the reduced need for construction labor attributable to the growing use by contractors of labor-saving equipment and of materials prefabricated in manufacturing industries.

Industrial Impact of Construction Activity

CONSTRUCTION activity affects many industries because of its direct and indirect requirements for a wide variety of products and services. Lumber, glass, concrete, structural steel, pipe, wire and cable, building paper and board, gypsum products, heating, plumbing, and structural metal products, lighting fixtures, paint, landscaping sod and shrubs, architectural and engineering services, and equipment rentals and repairs are among the major items directly required in construction activity. In addition, numerous raw materials, semifinished goods, containers, supplies, and services are required to produce the goods and services (inputs) used directly in construction.

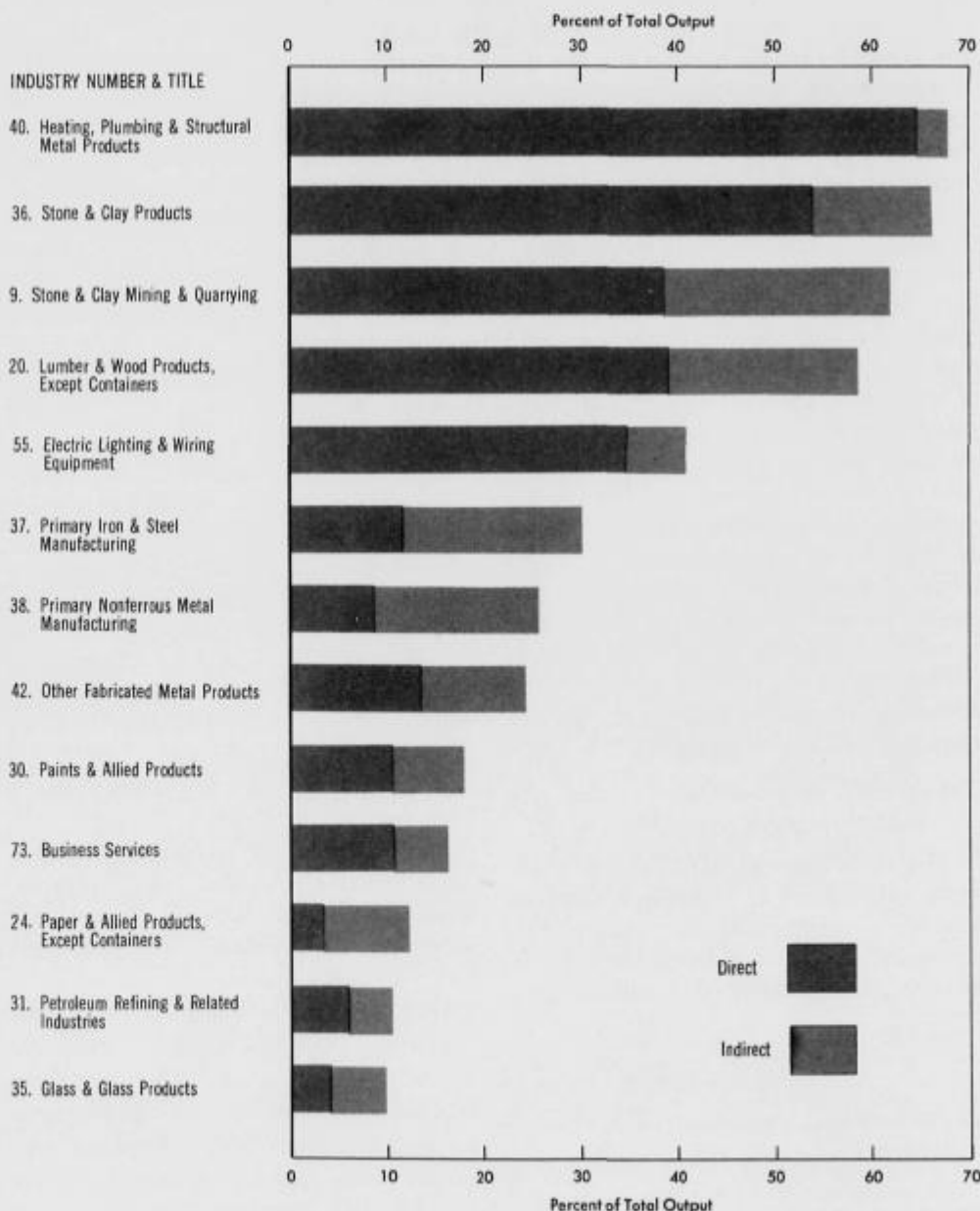
For example, structural metal products (industry 40) are fabricated from steel mill shapes (industry 37), which in turn are processed from iron (industry 5) and coal (industry 7). The output of structural metal products, steel mill shapes, iron, and coal requires still other inputs, such as chemicals, electric power, fuels, containers, office supplies, freight, warehousing, and telephone communications. The production of these items, in turn, uses still other inputs, and so the chain continues, resulting in the total output of the many materials and services necessary to produce the structural metal products used in construction. In this example, the structural metal products are *direct*

requirements, and all other items are *indirect* requirements generated by construction activity. The input-output

table permits the systematic estimation of these direct and indirect demands and thus the calculation of the total output from each industry in the economy required by a given level of construction activity.⁵

The widespread impact of construction activity is indicated in table 1 and charts 9 and 10. Table 1 shows for each industry the percent of its output attributable to construction in terms of direct requirements, indirect requirements, and the sum of the two, or total

Importance of New Construction in Generating Output in Selected Industries, 1958



⁴ The estimate of employment for the contract construction industry was based on employment series of the Bureau of Labor Statistics. The balance was developed in connection with the input-output data. The latter included estimates for self-employed contractors, force account construction employees of Government agencies and nonconstruction firms, speculative builders who do not work on contract, and employees of manufacturing companies who install construction-type equipment such as elevators.

⁵ The direct and total requirements data refer to the consumption of items associated with construction during a 1-year period. The supply may have come from domestic production, imports, or inventories carried over from the previous year. All data are in values rather than physical units. Thus, lumber requirements are expressed in 1958 dollars, not board feet.

Table 1.—Total, Direct, and Indirect Output Attributable to New Construction and Maintenance and Repair Construction, 1958
(Percent)

Producing industry	Related SIC codes (1957 edition)	New and maintenance and repair construction			New construction			Maintenance and repair construction		
		Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect
1. Livestock and livestock products.....	013, pt. 014, 0103, pt. 02, pt. 0729	1.3	0	1.3	1.1	0	1.1	0.2	0	0.2
2. Other agricultural products.....	011, 012, pt. 013, 0109, 0109, pt. 02	3.2	1.0	2.2	2.9	1.0	1.9	.3	0	.3
3. Forestry and fishery products.....	074, 081, 082, 084, 086, 091	36.7	0	36.7	32.4	0	32.4	4.3	0	4.3
4. Agricultural, forestry and fishery services.....	071, 0723, pt. 0730, 086, 098	3.0	0	3.0	3.4	0	3.4	.6	0	.6
5. Iron and ferrous ores mining.....	1011, 108	32.0	0	32.0	28.6	0	28.6	3.4	0	3.4
6. Nonferrous metal ores mining.....	102, 103, 104, 106, 108, 109	26.3	0	26.3	21.2	0	21.2	5.1	0	5.1
7. Coal mining.....	11, 12	14.3	(*)	14.3	12.3	(*)	12.3	2.0	0	2.0
8. Crude petroleum and natural gas.....	1311, 1321	12.6	(*)	12.6	9.8	(*)	9.8	2.8	0	2.8
9. Stone and clay mining and quarrying.....	141, 142, 144, 145, 148, 149	73.4	40.6	28.8	61.8	38.4	23.3	11.6	5.1	6.5
10. Chemical and fertilizer mineral mining.....	147	16.4	0	16.4	11.8	0	11.8	4.6	0	4.6
11. Ordnances and accessories.....	20	.8	.1	.7	.7	.1	.6	.1	0	.1
12. Food and kindred products.....	20	.0	(*)	.0	.7	(*)	.7	.2	0	.2
13. Tobacco manufactures.....	21	.5	0	.5	.4	0	.4	.1	0	.1
14. Broad and narrow fabrics, yarn and thread mills.....	221, 222, 223, 224, 226, 228	2.0	0	2.0	1.7	0	1.7	.3	0	.3
15. Miscellaneous textile goods and floor coverings.....	227, 229	4.9	.2	4.7	4.2	.2	4.0	.7	(*)	.7
16. Apparel.....	226, 23 (exc. 230), 3302	.4	0	.4	.3	0	.3	.1	0	.1
17. Miscellaneous fabricated textile products.....	230	1.8	(*)	1.8	1.6	(*)	1.6	.2	(*)	.2
18. Lumber and wood products, except containers.....	24 (exc. 244)	64.0	43.9	22.1	58.4	38.9	19.5	7.6	5.0	2.6
19. Wooden containers.....	244	12.4	0	12.4	10.6	0	10.6	1.8	0	1.8
20. Household furniture.....	251	10.3	9.0	1.3	10.1	9.0	1.1	.2	0	.2
21. Other furniture and fixtures.....	25 (exc. 251)	16.5	14.8	1.8	15.3	13.7	1.6	1.8	1.1	.7
22. Paper and allied products, except containers.....	26 (exc. 265)	14.4	2.7	10.7	12.1	3.1	9.0	2.3	0	2.3
23. Paperboard containers and boxes.....	265	10.2	0	10.2	8.3	0	8.3	1.9	0	1.9
24. Printing and publishing.....	27	10.9	.1	10.8	9.9	.1	9.8	1.0	(*)	1.0
25. Chemical and selected chemical products.....	28 (exc. alumina pt. of 2810), 285, 287, 290	15.9	2.0	12.9	11.4	3.0	8.4	4.5	.6	3.9
26. Plastics and synthetic materials.....	282	13.4	0	13.4	9.1	0	9.1	4.3	0	4.3
27. Drugs, cleaning, and toilet preparations.....	283, 284	2.6	0	2.6	1.9	0	1.9	.7	0	.7
28. Paints and allied products.....	285	66.0	57.4	8.6	17.7	10.6	7.2	48.8	38.8	10.0
29. Petroleum refining and related industries.....	29	13.2	7.6	5.6	10.1	4.5	5.6	3.1	2.1	1.0
30. Rubber and miscellaneous plastics products.....	30	12.6	5.5	7.1	10.5	4.4	6.0	2.1	1.6	.5
31. Leather tanning and industrial leather products.....	311, 313	1.2	0	1.2	1.1	0	1.1	.2	0	.2
32. Footwear and other leather products.....	31 (exc. 311, 313)	.4	(*)	.4	.3	(*)	.3	.1	(*)	.1
33. Glass and glass products.....	321, 322, 323	14.5	7.6	6.9	9.7	3.9	5.8	4.8	3.7	1.1
34. Stone and clay products.....	324, 325, 326, 327, 328, 329	75.3	60.0	15.3	53.7	43.7	10.0	21.6	10.9	10.7
35. Primary iron and steel, manufacturing.....	331, 332, 3301, 3309	24.4	12.9	11.5	20.0	11.5	8.5	4.4	1.4	3.0
36. Primary nonferrous metal manufacturing.....	3319 (alumina only), 333, 334, 335, 336, 3392	21.3	11.4	9.9	26.8	8.6	18.2	0.2	3.8	2.4
37. Metal containers.....	3411, 3401	6.5	0	6.5	2.8	0	2.8	3.7	0	3.7
38. Heating, plumbing and structural metal products.....	343, 344	70.0	78.4	3.6	67.8	64.6	3.2	11.4	10.9	.5
39. Stampings, screw machine products, and bolts.....	345, 346	14.8	3.0	11.8	12.5	2.4	10.1	2.3	.8	1.5
40. Other fabricated metal products.....	342, 347, 348, 349 (exc. 3401)	26.5	14.1	12.4	24.0	13.3	10.7	2.5	.8	1.7
41. Engines and turbines.....	351	4.5	.1	4.4	4.9	.1	4.8	.7	(*)	.7
42. Farm machinery and equipment.....	352	2.9	.1	2.8	2.6	.1	2.5	.4	0	.4
43. Construction, mining and oil field machinery.....	353, 354, 355, 356	12.0	6.2	5.8	10.5	5.5	5.0	1.5	.7	.8
44. Material handling machinery and equipment.....	3534, 3535, 3536, 3537	23.6	22.0	1.6	27.4	23.5	3.9	4.6	1.4	3.2
45. Metalworking machinery and equipment.....	354	7.2	(*)	7.2	6.2	(*)	6.2	1.0	(*)	1.0
46. Special industry machinery and equipment.....	355	4.2	0	4.2	3.6	0	3.6	.7	0	.7
47. General industrial machinery and equipment.....	356	15.5	7.8	7.7	13.0	7.3	5.7	1.6	.8	.8
48. Machine shop products.....	359	10.2	.3	10.1	8.9	.2	8.7	1.4	(*)	1.4
49. Office, computing and accounting machines.....	367	5.0	0	5.0	4.6	0	4.6	.4	0	.4
50. Service industry machines.....	368	14.9	9.7	5.2	13.2	8.7	4.5	1.7	1.0	.7
51. Electric industrial equipment and apparatus.....	361, 362	17.8	9.7	8.1	14.7	8.2	6.5	2.6	1.5	1.1
52. Household appliances.....	365	10.0	7.4	2.6	7.9	5.7	2.2	2.1	1.7	.4
53. Electric lighting and wiring equipment.....	364	47.1	40.0	7.1	40.7	34.5	6.2	6.4	5.4	1.0
54. Radio, television and communication equipment.....	365, 366	2.3	1.0	1.3	1.7	.5	1.2	.6	(*)	.6
55. Electronic components and accessories.....	367	3.3	.1	3.2	3.2	.1	3.1	.6	(*)	.6
56. Miscellaneous electrical machinery, equipment and supplies.....	360	7.3	1.2	6.1	6.1	.2	5.9	1.2	.3	.9
57. Motor vehicles and equipment.....	371	1.5	(*)	1.5	1.2	(*)	1.2	.3	(*)	.3
58. Aircraft and parts.....	372	.8	0	.8	.7	0	.7	.1	0	.1
59. Other transportation equipment.....	373, 374, 375, 379	3.9	.1	3.8	3.4	.1	3.3	.6	0	.6
60. Scientific and controlling instruments.....	381, 382, 384, 387	10.0	5.7	4.3	9.0	5.8	3.2	1.0	.4	.6
61. Optical, ophthalmic and photographic equipment.....	383, 385, 386	2.8	(*)	2.8	2.4	(*)	2.4	.4	(*)	.4
62. Miscellaneous manufacturing.....	39 (exc. 3902)	6.2	2.4	3.8	4.5	1.5	3.0	1.4	.8	.6
63. Transportation and warehousing.....	40, 41, 42, 44, 45, 46, 47	14.2	6.3	7.9	12.8	6.3	6.5	2.2	.9	1.3
64. Communications except radio and television broadcasting.....	481, 492, 499	8.7	1.4	7.3	7.7	1.2	6.5	1.0	.2	.8
65. Radio and television broadcasting.....	493	16.9	0	16.9	15.4	0	15.4	1.5	0	1.5
66. Electric, gas, water, and sanitary services.....	49	7.3	.8	6.5	6.1	.7	5.4	1.2	.1	1.1
67. Wholesale and retail trade.....	50 (exc. mfg. sales offices), 52, 53, 54, 55, 56, 57, 58, 59, 74, 7500	8.2	0.6	7.6	7.4	0.2	7.2	1.0	1.4	.4
68. Finance and insurance.....	60, 61, 62, 63, 64, 65, 67	0.2	1.8	1.6	5.3	1.6	3.7	.9	.2	.7
69. Real estate and rental.....	65 (exc. 6541 and pt. 6541)	3.2	.4	2.8	2.0	.3	1.7	.5	.1	.4
70. Hotels, personal and repair services, except automobiles.....	70, 72, 76 (exc. 7094 and 7095)	2.1	0	2.1	1.8	0	1.8	.3	0	.3
71. Business services.....	8041, 71 (exc. 7361, 7361 and pt. 7361), 7094, 7099, 81, 89 (exc. 8921)	17.2	10.7	6.5	16.9	10.5	6.4	1.3	.2	1.1
72. Research and development.....	73	.4	0	.4	.3	0	.3	.1	0	.1
73. Automobile repair and services.....	75	8.0	3.6	4.4	7.0	3.3	3.7	1.0	.3	.7
74. Amusements.....	79, 80	2.1	0	2.1	1.9	0	1.9	.2	0	.2
75. Medical, educational, services, and non-profit organization.....	8022, 7361, 80, 82, 84, 86, 8921	.7	.3	.4	.6	.3	.3	.1	(*)	.1
76. Federal Government enterprises.....		8.2	0	8.2	7.6	0	7.6	1.2	0	1.2
77. State and local government enterprises.....		8.2	.3	7.9	6.8	.3	6.5	1.3	(*)	1.3
78. Gross imports of goods and services.....		0.8	0	0.8	8.0	0	8.0	1.8	.9	1.8
79. Business, travel, entertainment, and gifts.....		14.7	4.0	10.7	12.3	3.4	8.9	2.4	.6	1.8
80. Office supplies.....		10.0	1.2	8.8	8.0	1.0	7.0	1.4	.2	1.2

*Less than .06 percent. Source: U.S. Department of Commerce, Office of Business Economics.

Table 2.—Direct Requirements Per Dollar of Selected Types of New Construction and Maintenance and

Producing industry	New construction														
	Total new construction ¹	Residential bldgs. (nonfarm)			Nonresidential buildings				Public utilities				Oil and gas well drilling and exploration	Water systems	Sewer systems
		Total ²	1-4 family	Public dwelling units	Total ³	Office	Educational	Hospital and institutional	Railroads and local transit	Gas and petroleum pipelines	Electric light and power	Telephone and telegraph			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Livestock and livestock products.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2. Other agricultural products.....	0.00482	0.00773	0.00412	0.00691	0.00901	0.00643	0.00121	0.00777	0	0	0	0	0	0	0
3. Forestry and fishery products.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4. Agricultural, forestry, and fishery services.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5. Iron and ferrous alloy ores mining.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6. Nonferrous metal ores mining.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7. Coal mining.....	0	0	0	0	0	0	0	0	0	0	0	0	0.0083	0	0
8. Crude petroleum and natural gas.....	0	0	0	0	0	0	0	0	0	0	0	0	0.0082	0	0
9. Stone and clay mining and quarrying.....	0.0193	0.0296	0.0326	0.0388	0.0236	0.0267	0.0237	0.0211	0.0103	0.0163	0.0254	0.0049	0.0046	0.0044	0.0298
10. Chemical and fertilizer mineral mining.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11. New construction.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12. Maintenance and repair construction.....	0.0012	0.0014	0.0014	0.0014	0.0015	0.0015	0.0014	0.0015	0.0004	0.0005	0.0012	0.0005	0.0012	0.0012	0.0014
13. Ordnance and accessories.....	0.0010	0	0	0	0	0	0	0	0	0	0	0	0.0012	0	0
14. Food and kindred products.....	0.0037	0	0	0	0	0	0	0	0	0	0	0	0.0012	0	0
15. Tobacco manufactures.....	0	0	0	0	0	0	0	0	0	0	0	0	0.0012	0	0
16. Broad and narrow fabrics, yarn and thread mills.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17. Miscellaneous textile goods and floor coverings.....	0.0007	0.0007	0.0007	0.0007	0.0008	0.0007	0.0007	0.0007	0.0008	0.0012	0.0008	0.0006	0.0007	0.0007	0.0007
18. Apparel.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19. Miscellaneous fabricated textile products.....	0.0001	0	0	0	0	0.0001	0	0.0001	0	0	0	0	0	0	0
20. Lumber and wood products, except containers.....	0.0239	0.1175	0.1208	0.1180	0.0270	0.0322	0.0464	0.0322	0.0680	0.0090	0.0020	0.0209	0.0004	0.0090	0.0104
21. Wooden containers.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22. Household furniture.....	0.0586	0.1342	0.1380	0.1392	0.0191	0.0387	0.1387	0.0030	0.0319	0.0005	0.0064	0.0073	0	0	0
23. Other furniture and fixtures.....	0.0090	0.0122	0.0170	0.0170	0.0191	0.0387	0.1387	0.0030	0.0319	0.0005	0.0064	0.0073	0	0	0
24. Paper and allied products, except containers.....	0.0017	0.0013	0.0030	0.0028	0.0181	0.0194	0.1781	0.0004	0.0157	0	0.0070	0.0048	0	0	0
25. Paperboard containers and boxes.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26. Printing and publishing.....	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0008	0.0013	0.0008	0.0013	0.0013	0.0016
27. Chemicals and selected chemical products.....	0.0704	0.0165	0.0163	0.0167	0.0084	0.0100	0.0061	0.0072	0.0101	0.0125	0.0051	0.0028	0.0101	0.0045	0.0034
28. Plastics and synthetic materials.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29. Drugs, cleaning, & toilet preparations.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30. Paints and allied products.....	0.0075	0.0040	0.0061	0.0049	0.0019	0.0024	0.0004	0.0028	0.0072	0.0040	0.0009	0.0052	0	0.0104	0.0022
31. Petroleum refining and related industries.....	0.0362	0.0130	0.0178	0.0142	0.0118	0.0083	0.0177	0.0114	0.0025	0.0120	0.0126	0.0037	0.0030	0.0120	0.0061
32. Rubber & miscellaneous plastics products.....	0.0094	0.0091	0.0082	0.0087	0.0179	0.0163	0.0049	0.0041	0.0070	0.0158	0.0019	0.0064	0.0023	0.0028	0.0021
33. Leather tanning & leather products.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34. Footwear and other leather products.....	0.0001	0.0004	0.0004	0.0001	0.0001	0.0001	0.0001	0.0001	0	(*)	0.0001	(*)	0.0001	0.0001	0.0001
35. Glass and glass products.....	0.0163	0.0161	0.0131	0.0192	0.0037	0.0039	0.0041	0.0027	0.0005	0.0052	0.0062	0.0061	0.0046	0.0044	0.0062
36. Stone and clay products.....	0.0770	0.0493	0.0930	0.0467	0.0660	0.0650	0.0612	0.0671	0.0147	0.0064	0.0108	0.0146	0.1228	0.1317	0.2250
37. Primary iron and steel manufacturing.....	0.0440	0.0212	0.0198	0.0275	0.0280	0.0177	0.0193	0.0197	0.0047	0.0047	0.0047	0.0047	0.0047	0.1186	0.0472
38. Primary nonferrous metal mfg.....	0.0163	0.0184	0.0168	0.0178	0.0125	0.0121	0.0098	0.0095	0.0010	0.0023	0.0008	0.0008	0.0008	0.0128	0.0007
39. Metal containers.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40. Heating, plumbing, and structural metal products.....	0.0006	0.0082	0.0007	0.0073	0.0073	0.0073	0.0073	0.0073	0.0073	0.0073	0.0073	0.0073	0.0073	0.0073	0.0073
41. Stampings, screw mach. prod., & bolts.....	0.0163	0.0136	0.0136	0.0136	0.0136	0.0136	0.0136	0.0136	0.0136	0.0136	0.0136	0.0136	0.0136	0.0136	0.0136
42. Other fabricated metal products.....	0.0163	0.0136	0.0136	0.0136	0.0136	0.0136	0.0136	0.0136	0.0136	0.0136	0.0136	0.0136	0.0136	0.0136	0.0136
43. Engines and turbines.....	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
44. Farm machinery and equipment.....	0.0006	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45. Construction, mining, and oil field machinery.....	0.0025	0.0017	0.0016	0.0016	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017
46. Materials handling mach. and equip.....	0.0477	0.0183	0	0.0181	0.0188	0.0188	0.0188	0.0188	0.0188	0.0188	0.0188	0.0188	0	0.0039	0.0006
47. Metalworking machinery and equipment.....	0.0082	0.0040	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	(*)	0.0001	0.0002	0.0001	0.0002	0.0002	0.0002
48. Special industry machinery and equipment.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49. General industrial machinery and equipment.....	0.0031	0.0030	0.0031	0.0031	0.0031	0.0031	0.0031	0.0031	0.0031	0.0031	0.0031	0.0031	0.0031	0.0031	0.0031
50. Machine shop products.....	0.0045	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
51. Office, computing, and account. mach.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52. Service industry machines.....	0.0074	0.0004	0.0004	0	0.0033	0.0000	0.0033	0.0033	0.0033	0.0033	0.0033	0.0033	0.0033	0.0033	0.0033
53. Electric indus. equip. & apparatus.....	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
54. Household appliances.....	0.0092	0.0078	0.0082	0.0101	0.0082	0.0082	0.0082	0.0082	0.0082	0.0082	0.0082	0.0082	0.0082	0.0082	0.0082
55. Electric lighting and wiring equipment.....	0.0117	0.0070	0.0074	0.0100	0.0084	0.0084	0.0084	0.0084	0.0084	0.0084	0.0084	0.0084	0.0084	0.0084	0.0084
56. Radio, TV, and communication equip.....	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070
57. Electronic components and accessories.....	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
58. Elec. electrical mach. equip. & app.....	0.0028	0.0019	0.0021	0.0022	0.0042	0.0041	0.0040	0.0038	0.0013	0.0007	0.0009	0.0004	0.0010	0.0018	0.0015
59. Motor vehicles and equipment.....	0.0002	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
60. Aircraft and parts.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61. Other transportation equipment.....	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005

Repair Construction, 1958

New construction—Continued		Maintenance and repair construction			
Highways	Conservation and development	Total	Residential buildings (non-farm)	Nonresidential buildings	Highways
16	17	18	19	20	21
0.01131	0.00941	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0.07266	0.04377	0.02777	0.00114	0.00032	0.03306
0	0	0	0	0	0
0.0014	0.0012	0.0006	0.00008	0.00008	0.00004
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0.0002	0.0004	0.0000	0.00007	0.00005	0.00003
0	0	0	0	0	0
0.00827	0.00113	0.00004	0	0.00002	0.00001
0	0.02415	0.02470	0.00050	0.00003	0.00722
0	0	0	0	0	0
0	0	0	0	0	0
0.00004	0.00341	0.00098	0.00009	0.00040	0.00010
0	0	0.00404	0.01075	0.00033	0
0	0	0	0	0	0
0.00040	0.00014	0.00007	0.00011	0.00010	0.00002
0	0	0	0	0	0
0.00301	0.00053	0.00119	0.00004	0.00170	0.00045
0	0	0	0	0	0
0	0	0	0	0	0
0.00038	0.00440	0.00711	0.00270	0.02422	0.01390
0.0044	0.03430	0.02222	0.00004	0.02378	0.00751
0.00008	0.00381	0.00391	0.00023	0.00448	0.00043
0	0	0	0	0	0
0.00001	0.00004	0	0.00001	0	0
0.00049	0.00072	0.00483	0.00240	0.00580	0.00020
0.00009	0.00440	0.00248	0.00006	0.00260	0.00281
0.00729	0.00872	0.01823	0.01106	0.00905	0.00902
0.00317	0.00198	0.01668	0.01078	0.01106	0.00640
0	0	0	0	0	0
0.00718	0.02928	0.02222	0.00784	0.00006	0.01378
0.00038	0.00157	0.00124	0.00101	0.00094	0.00022
0.00447	0.00081	0.00308	0.00017	0.00024	0.00027
0.00004	0.00004	0.00002	0.00008	0.00003	0
0	0	0	0	0	0
0.00402	0.00285	0.00136	0.00123	0.00134	0.00027
0	0.00034	0.00049	0.00042	0.00035	0.00002
0.00002	0.00002	0.00001	0.00002	0.00002	0
0	0	0	0	0	0
0.00004	0.00023	0.00111	0.00217	0.00122	0.00001
0.00005	0.00005	0.00002	0.00004	0.00003	0.00001
0	0	0	0	0	0
0.00415	0.00005	0.00129	0.00014	0.00334	0.00009
0	0.00007	0.00107	0.00001	0.00040	0.00009
0.00009	0.00354	0.00009	0.00009	0.00009	0
0.00021	0.00379	0.00729	0.00270	0.00081	0.00000
0	0	0.00128	0	0	0.00044
0	0	0.00004	0	0	0
0.00021	0.00064	0.00029	0.00044	0.00028	0.00000
0.00003	0.00002	0.00001	0.00002	0.00002	0
0	0	0	0	0	0
0.00004	0.00003	0	0	0	0
0.00002	0	0.00004	0.00000	0.00298	0
0	0	0	0	0	0
0.00008	0.00003	0.00287	0.00015	0.00100	0.00037
0.00002	0.00019	0.01708	0.01783	0.00902	0.02741
0.00220	0.00500	0.01097	0.00108	0.00122	0.00024
0	0	0	0	0	0
0.00005	0.00279	0.00148	0.00233	0.00014	0.00033
0	0	0	0	0	0
0.07758	0.00447	0.0170	0.00338	0.00219	0.01111
0.00004	0.00008	0.00002	0.00002	0.00013	0.00004
0.00426	0.00390	0.00207	0.00325	0.00204	0.00066
0	0	0	0	0	0
0.00005	0.00002	0.00356	0.00588	0.00505	0.00070
0	0	0	0	0	0
0.00536	0.00491	0.00133	0.00008	0.00188	0.00020
0	0	0	0	0	0
0.00118	0.00108	0.00057	0.00000	0.00061	0.00013
0	0	0	0	0	0
0.00027	0.00025	0.00013	0.00021	0.00010	0.00003
0	0	0	0	0	0
0.00405	0.00118	0.00227	0.00348	0.00315	0.00049
0.00025	0.00025	0.00314	0.00031	0.00030	0.00003
0.00128	0.00128	0.00072	0.00112	0.00102	0.00016
0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
10.4	1.9	100.0	25.1	23.9	14.1

requirements. Chart 9 illustrates some of the more important industries. Part of the production of every one of the industries distinguished in the input-output study was attributable to the requirements of construction. Even such remotely connected industries as livestock and tobacco were to some extent dependent on the volume of construction in 1958.

Construction accounted for at least 50 percent of the total output of 5 industries, 25 percent for 13 industries, and 10 percent for 39 industries. It is interesting to note the importance of indirect requirements in the output of individual industries. As much as 22 percent of total lumber output was indirectly attributable to construction activity, in addition to the 44 percent that was directly used. Several industries sold little to construction directly but attributed 10 percent or more of their output indirectly to construction. Examples are the mining industries (excluding stone and clay mining), wooden containers, paperboard containers, printing and publishing, plastics, machine shop products, and radio and TV broadcasting.

The industrial impact of new construction differed sharply from that of maintenance and repair construction, both in the kinds of industries affected and in the relative amounts of output required. As noted above, the volume of new construction was three times the volume of maintenance and repair. In most industries, however, the output attributable to new construction was considerably more than three times the output attributable to maintenance and repairs. This reflected primarily the fact that materials and services accounted for 65 percent, and value added for 35 percent, of every dollar of new construction; the corresponding breakdown for every dollar of maintenance and repair construction was 39 percent and 61 percent. The paint industry was the exception to this general pattern because of the importance of paint in maintenance and repair construction. Almost 50 percent of the output of the paint industry was required for maintenance and repair, as compared with 18 percent for new construction.

Variations in Requirements by Type of Construction

The kinds and relative amounts of materials and services used vary widely from one type of construction to another. Table 2 presents the 1958 direct requirements per dollar of new construction and of maintenance and repair construction. These ratios are referred to as input coefficients. Table 3 provides information on total (direct plus indirect) requirements per dollar of construction. In both tables, data are given for each of several types of construction for which reasonably reliable figures are available; these types accounted for 90 percent of new and 75 percent of maintenance and repair construction in 1958. Data for the other types of construction are available on request.

Detailed information of this kind permits the calculation of the industrial output required by a specific type of construction. It also makes possible a more accurate measurement of the production requirements of total construction for a year in which the relative importance of the various types of construction may differ from that of 1958.

Focusing on the total requirements for the major material inputs into new construction, we see in table 3 for example, that the requirements for lumber and wood products (industry 20) ranged from a high of 19 cents per dollar of construction of one- to four-family dwellings to a low of one cent per dollar of electric power facilities and water systems construction. The requirements for stone and clay products (industry 36) were approximately 10 cents per dollar of residential and nonresidential building, 2 cents for public utilities, 16 cents for water systems, and 26 cents for sewer systems. Total requirements for heating, plumbing, and structural metal products (industry 40) were 9 cents for one- to four-family housing, 15 cents for hospitals, 5 cents for telephone, and 10 cents for highway construction. Wholesale and retail trade (industry 69) requirements were approximately 15 cents for residential and nonresidential building, 5 cents for oil and gas well drilling and exploration, and 9 cents

Table 3.—Total Requirements (Direct and Indirect) Per Dollar of Selected Types of New Construction and Maintenance

Producing industry	Total new construction ¹	New construction														
		Residential bldgs. (nonfarm)			Nonresidential buildings				Public utilities					Oil and gas well drilling and exploration	Water systems	Sewer systems
		Total ²	1-4 family	Public dwell. units	Total ²	Offices	Educational	Hospital and institutional	Railroads and local transit	Gas and petroleum pipelines	Electric light and power	Telephone and telegraph				
													1	2	3	4
1. Livestock and livestock products.....	0.00549	0.00674	0.00649	0.00641	0.00493	0.00498	0.00628	0.00465	0.00159	0.00246	0.00283	0.00283	0.00580	0.00326	0.00326	0.00327
2. Other agricultural products.....	0.00292	0.01044	0.01041	0.01048	0.00782	0.00628	0.00932	0.00738	0.00210	0.00350	0.00348	0.00449	0.00453	0.00411	0.00606	0.00606
3. Forestry and fishery products.....	0.00298	0.01721	0.01787	0.00443	0.00518	0.00334	0.00810	0.00518	0.00144	0.00496	0.00496	0.00490	0.00448	0.00386	0.00191	0.00191
4. Agri., forestry, and fishery services.....	0.00101	0.01111	0.00138	0.00102	0.00076	0.00068	0.00088	0.00071	0.00022	0.00038	0.00033	0.00047	0.00036	0.00028	0.00046	0.00046
5. Iron and ferrous metal ore mining.....	0.00070	0.00821	0.00483	0.00804	0.00640	0.00528	0.00002	0.00616	0.00200	0.00391	0.01116	0.00043	0.00048	0.00041	0.00036	0.00036
6. Nonferrous metal ore mining.....	0.00033	0.00092	0.00040	0.00003	0.00031	0.00023	0.00000	0.00024	0.00028	0.00047	0.00304	0.00040	0.00047	0.00041	0.00036	0.00036
7. Coal mining.....	0.00030	0.00055	0.00026	0.00003	0.00046	0.00026	0.00026	0.00010	0.00027	0.00047	0.00071	0.00040	0.00047	0.00041	0.00036	0.00036
8. Crude petroleum and natural gas.....	0.00022	0.00070	0.00016	0.00020	0.00049	0.00023	0.00018	0.00018	0.00018	0.00018	0.00018	0.00018	0.00018	0.00018	0.00018	0.00018
9. Stone and clay mining and quarrying.....	0.00016	0.00035	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
10. Chemical and fertilizer in metal mining.....	0.00017	0.00013	0.00016	0.00012	0.00013	0.00014	0.00012	0.00014	0.00012	0.00012	0.00012	0.00012	0.00012	0.00012	0.00012	0.00012
11. New construction.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12. Maintenance and repair construction.....	0.00196	0.00227	0.00231	0.00184	0.00135	0.00123	0.00131	0.00130	0.00119	0.00139	0.00117	0.00139	0.00124	0.00124	0.00127	0.00127
13. Ordnance and accessories.....	0.00050	0.00039	0.00038	0.00037	0.00038	0.00039	0.00038	0.00038	0.00038	0.00038	0.00038	0.00038	0.00038	0.00038	0.00038	0.00038
14. Food and kindred products.....	0.00041	0.00043	0.00041	0.00040	0.00041	0.00041	0.00041	0.00041	0.00041	0.00041	0.00041	0.00041	0.00041	0.00041	0.00041	0.00041
15. Tobacco manufactures.....	0.00042	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043
16. Broad and narrow fabrics, yarn and thread mills.....	0.00061	0.00047	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043	0.00043
17. Misc. textile goods and floor coverings.....	0.00200	0.00221	0.00224	0.00216	0.00267	0.00261	0.00248	0.00222	0.00068	0.00124	0.00114	0.00149	0.00069	0.00126	0.00149	0.00149
18. Apparel.....	0.00091	0.00190	0.00096	0.00097	0.00107	0.00107	0.00122	0.00123	0.00038	0.00077	0.00067	0.00078	0.00080	0.00079	0.00083	0.00083
19. Misc. fabricated textile products.....	0.00070	0.00071	0.00071	0.00071	0.00078	0.00077	0.00078	0.00070	0.00070	0.00074	0.00076	0.00074	0.00076	0.00074	0.00077	0.00077
20. Lumber and wood prod., exc. containers.....	0.00280	0.01133	0.00931	0.00917	0.00578	0.00320	0.00300	0.00306	0.00044	0.00306	0.00287	0.00301	0.00275	0.00284	0.00304	0.00304
21. Wood containers.....	0.00001	0.00119	0.00118	0.00098	0.00094	0.00096	0.00097	0.00083	0.00023	0.00046	0.00032	0.00040	0.00035	0.00036	0.00037	0.00037
22. Household furniture.....	0.00037	0.00144	0.00143	0.00101	0.00094	0.00098	0.00098	0.00091	0.00020	0.00020	0.00020	0.00021	0.00018	0.00018	0.00018	0.00018
23. Other furniture and fixtures.....	0.00037	0.00182	0.00047	0.00226	0.00283	0.00300	0.00446	0.00292	0.00239	0.00239	0.00025	0.00049	0.00061	0.00077	0.00077	0.00077
24. Paper and allied prod., exc. containers.....	0.00340	0.02410	0.01472	0.02258	0.03054	0.03890	0.04033	0.02074	0.00745	0.01370	0.01032	0.01112	0.01083	0.01280	0.01280	0.01280
25. Paperboard containers and boxes.....	0.00579	0.00616	0.00628	0.00613	0.00737	0.00746	0.00746	0.00732	0.00230	0.00321	0.00338	0.00376	0.00346	0.00346	0.00361	0.00361
26. Printing and publishing.....	0.00274	0.01880	0.01920	0.01803	0.02371	0.02340	0.02311	0.00370	0.00339	0.01084	0.02779	0.01257	0.02340	0.01186	0.02362	0.02362
27. Chemicals and selected chemical prod.....	0.00747	0.01313	0.02104	0.02077	0.02024	0.02014	0.01828	0.01848	0.00180	0.01854	0.01340	0.01454	0.01190	0.02324	0.02276	0.02276
28. Plastics and synthetic materials.....	0.00740	0.00822	0.00843	0.00790	0.00889	0.00912	0.00865	0.00787	0.00293	0.00309	0.00497	0.00305	0.00368	0.00346	0.00372	0.00372
29. Drugs, cleaning, & toilet preparations.....	0.00034	0.00248	0.00233	0.00243	0.00233	0.00233	0.00233	0.00087	0.00239	0.00087	0.00139	0.00103	0.00208	0.00207	0.00318	0.00318
30. Paints and allied products.....	0.00043	0.00045	0.00070	0.00083	0.00041	0.00079	0.00080	0.00045	0.00084	0.00235	0.00081	0.00124	0.00128	0.00227	0.00280	0.00280
31. Petroleum refining and related indus.....	0.00401	0.02359	0.02340	0.02360	0.02324	0.02410	0.02376	0.02392	0.01106	0.02786	0.02786	0.02184	0.01496	0.01794	0.02786	0.02786
32. Rubber and misc. plastics prod.....	0.01385	0.01442	0.01431	0.01401	0.01357	0.01405	0.01784	0.01744	0.00294	0.00782	0.00716	0.00624	0.00602	0.00604	0.01048	0.01048
33. Leather tanning and indus. leather prod.....	0.00010	0.00019	0.00010	0.00022	0.00027	0.00029	0.00023	0.00026	0.00006	0.00011	0.00010	0.00011	0.00008	0.00012	0.00014	0.00014
34. Footwear and other leather products.....	0.00023	0.00023	0.00023	0.00024	0.00027	0.00030	0.00024	0.00023	0.00007	0.00015	0.00014	0.00012	0.00012	0.00012	0.00018	0.00018
35. Glass and glass products.....	0.00407	0.00881	0.00861	0.00851	0.00874	0.00882	0.00843	0.00815	0.00230	0.00149	0.00240	0.00263	0.00127	0.00108	0.00187	0.00187
36. Stone and clay products.....	0.00384	0.01194	0.01092	0.01059	0.00828	0.00828	0.00821	0.00815	0.00332	0.01190	0.02342	0.02342	0.01921	0.01708	0.02342	0.02342
37. Primary iron and steel manufacturing.....	0.01060	0.04488	0.04284	0.04300	0.04040	0.04076	0.04020	0.04005	0.04310	0.02394	0.04265	0.04265	0.04265	0.04265	0.04265	0.04265
38. Primary nonferrous metal mfg.....	0.00194	0.00194	0.00194	0.00194	0.00194	0.00194	0.00194	0.00194	0.00194	0.00194	0.00194	0.00194	0.00194	0.00194	0.00194	0.00194
39. Metal containers.....	0.00115	0.00124	0.00127	0.00122	0.00114	0.00106	0.00117	0.00104	0.00044	0.00087	0.00080	0.00087	0.00114	0.00077	0.00096	0.00096
40. Heating, plumbing, and suspended metal products.....	0.00384	0.00390	0.00312	0.00378	0.00341	0.00341	0.00383	0.00348	0.00384	0.00384	0.00384	0.00384	0.00384	0.00384	0.00384	0.00384
41. Blauprops, screw mach. products, bolts.....	0.00388	0.00617	0.00781	0.00790	0.00721	0.00734	0.00753	0.00729	0.00318	0.00388	0.00388	0.00388	0.00388	0.00388	0.00388	0.00388
42. Other fabricated metal products.....	0.00389	0.00387	0.00412	0.00416	0.00382	0.00382	0.00382	0.00382	0.00382	0.00382	0.00382	0.00382	0.00382	0.00382	0.00382	0.00382
43. Engines and turbines.....	0.00384	0.00178	0.00183	0.00263	0.00380	0.00380	0.00387	0.00383	0.00383	0.00383	0.00383	0.00383	0.00383	0.00383	0.00383	0.00383
44. Farm machinery and equipment.....	0.00327	0.00104	0.00097	0.00129	0.00139	0.00124	0.00128	0.00128	0.00128	0.00128	0.00128	0.00128	0.00128	0.00128	0.00128	0.00128
45. Construction, mining, and all kind machinery.....	0.00321	0.00303	0.00338	0.00311	0.00497	0.00497	0.00497	0.00497	0.00497	0.00497	0.00497	0.00497	0.00497	0.00497	0.00497	0.00497
46. Materials handling mach. and equip.....	0.00573	0.00354	0.00363	0.00387	0.00421	0.00407	0.00402	0.00402	0.00402	0.00402	0.00402	0.00402	0.00402	0.00402	0.00402	0.00402
47. Metalworking machinery and equipment.....	0.00343	0.00582	0.00364	0.00536	0.00556	0.00556	0.00556	0.00556	0.00556	0.00556	0.00556	0.00556	0.00556	0.00556	0.00556	0.00556
48. Special industry machinery and equipment.....	0.00100	0.00189	0.00185	0.00194	0.00301	0.00198	0.00192	0.00185	0.00046	0.00175	0.00100	0.00109	0.00141	0.00131	0.00138	0.00138
49. General industrial machinery and equipment.....	0.00003	0.00607	0.00723	0.01618	0.00079	0.00328	0.00167	0.00477	0.00182	0.00480	0.00003	0.00488	0.00447	0.00386	0.00338	0.00338
50. Machine shop products.....	0.00272	0.00390	0.00215	0.00333	0.00442	0.00334	0.00310	0.00393	0.00118	0.00344	0.00287	0.00313	0.00247	0.00346	0.00178	0.00178
51. Office, computing, and account machs.....	0.00194	0.00140	0.00146	0.00158	0.00228	0.00230	0.00232	0.00229	0.00002	0.00183	0.00228	0.00102	0.00204	0.00219	0.00280	0.00280
52. Service industry machines.....	0.00570	0.00219	0.00207	0.00257	0.00144	0.00274	0.00307	0.00301	0.00301	0.00301	0.00301	0.00301	0.00301	0.00301	0.00301	0.00301
53. Electric indus. equip. and apparatus.....	0.00483	0.00194	0.00207	0.00244	0.00293	0.00309	0.00310	0.00310	0.00310	0.00310	0.00310	0.00310	0.00310	0.00310	0.00310	0.00310
54. Household appliances.....	0.00343	0.00104	0.00083	0.00123	0.00268	0.00307	0.00303	0.00303	0.00303	0.00303	0.00303	0.00303	0.00303	0.00303	0.00303	0.00303
55. Electric lighting and wiring equipment.....	0.00183	0.00096	0.00113	0.00188	0.00268	0.00285	0.00315	0.00329	0.00301	0.00310	0.00310	0.00310	0.00310	0.00310	0.00310	0.00310
56. Radio, television, and communication equipment.....	0.00193	0.00186	0.00190	0.00221	0.00148	0.00203	0.00180	0.00170	0.00309	0.00309	0.00309	0.00309	0.00309	0.00309	0.00309	0.00309
57. Electronic components and accessories.....	0.00182	0.00195	0.00127	0.00190	0.00230	0.00315	0.00348	0.00270	0.00138	0.00083	0.00203	0.00119	0.00089	0.00082	0.00082	0.00082
58. Miscellaneous electrical machinery, equipment, and supplies.....	0.00160	0.00148	0.00149	0.00172	0.00237	0.00276	0.00240	0.00243	0.00092	0.00090						

² Also includes apartments, nonhousekeeping units and all residential additions and alterations.

* Also includes industrial, warehouses, stores, restaurants and garages, religious, social and recreational, and miscellaneous nonresidential building.

and Repair Construction, 1958

New construction—Continued		Maintenance and repair construction			
Highways	Conservation and development	Total	Residential buildings (non-farm)	Nonresidential buildings	Highways
16	17	18	19	20	21
0.0015	0.0019	0.0034	0.0033	0.0034	0.0042
0.0016	0.0020	0.0036	0.0035	0.0036	0.0044
0.0017	0.0021	0.0038	0.0037	0.0038	0.0046
0.0018	0.0022	0.0040	0.0039	0.0040	0.0048
0.0019	0.0023	0.0042	0.0040	0.0041	0.0050
0.0020	0.0024	0.0044	0.0041	0.0042	0.0052
0.0021	0.0025	0.0046	0.0042	0.0043	0.0054
0.0022	0.0026	0.0048	0.0043	0.0044	0.0056
0.0023	0.0027	0.0050	0.0044	0.0045	0.0058
0.0024	0.0028	0.0052	0.0045	0.0046	0.0060
0.0025	0.0029	0.0054	0.0046	0.0047	0.0062
0.0026	0.0030	0.0056	0.0047	0.0048	0.0064
0.0027	0.0031	0.0058	0.0048	0.0049	0.0066
0.0028	0.0032	0.0060	0.0049	0.0050	0.0068
0.0029	0.0033	0.0062	0.0050	0.0051	0.0070
0.0030	0.0034	0.0064	0.0051	0.0052	0.0072
0.0031	0.0035	0.0066	0.0052	0.0053	0.0074
0.0032	0.0036	0.0068	0.0053	0.0054	0.0076
0.0033	0.0037	0.0070	0.0054	0.0055	0.0078
0.0034	0.0038	0.0072	0.0055	0.0056	0.0080
0.0035	0.0039	0.0074	0.0056	0.0057	0.0082
0.0036	0.0040	0.0076	0.0057	0.0058	0.0084
0.0037	0.0041	0.0078	0.0058	0.0059	0.0086
0.0038	0.0042	0.0080	0.0059	0.0060	0.0088
0.0039	0.0043	0.0082	0.0060	0.0061	0.0090
0.0040	0.0044	0.0084	0.0061	0.0062	0.0092
0.0041	0.0045	0.0086	0.0062	0.0063	0.0094
0.0042	0.0046	0.0088	0.0063	0.0064	0.0096
0.0043	0.0047	0.0090	0.0064	0.0065	0.0098
0.0044	0.0048	0.0092	0.0065	0.0066	0.0100
0.0045	0.0049	0.0094	0.0066	0.0067	0.0102
0.0046	0.0050	0.0096	0.0067	0.0068	0.0104
0.0047	0.0051	0.0098	0.0068	0.0069	0.0106
0.0048	0.0052	0.0100	0.0069	0.0070	0.0108
0.0049	0.0053	0.0102	0.0070	0.0071	0.0110
0.0050	0.0054	0.0104	0.0071	0.0072	0.0112
0.0051	0.0055	0.0106	0.0072	0.0073	0.0114
0.0052	0.0056	0.0108	0.0073	0.0074	0.0116
0.0053	0.0057	0.0110	0.0074	0.0075	0.0118
0.0054	0.0058	0.0112	0.0075	0.0076	0.0120
0.0055	0.0059	0.0114	0.0076	0.0077	0.0122
0.0056	0.0060	0.0116	0.0077	0.0078	0.0124
0.0057	0.0061	0.0118	0.0078	0.0079	0.0126
0.0058	0.0062	0.0120	0.0079	0.0080	0.0128
0.0059	0.0063	0.0122	0.0080	0.0081	0.0130
0.0060	0.0064	0.0124	0.0081	0.0082	0.0132
0.0061	0.0065	0.0126	0.0082	0.0083	0.0134
0.0062	0.0066	0.0128	0.0083	0.0084	0.0136
0.0063	0.0067	0.0130	0.0084	0.0085	0.0138
0.0064	0.0068	0.0132	0.0085	0.0086	0.0140
0.0065	0.0069	0.0134	0.0086	0.0087	0.0142
0.0066	0.0070	0.0136	0.0087	0.0088	0.0144
0.0067	0.0071	0.0138	0.0088	0.0089	0.0146
0.0068	0.0072	0.0140	0.0089	0.0090	0.0148
0.0069	0.0073	0.0142	0.0090	0.0091	0.0150
0.0070	0.0074	0.0144	0.0091	0.0092	0.0152
0.0071	0.0075	0.0146	0.0092	0.0093	0.0154
0.0072	0.0076	0.0148	0.0093	0.0094	0.0156
0.0073	0.0077	0.0150	0.0094	0.0095	0.0158
0.0074	0.0078	0.0152	0.0095	0.0096	0.0160
0.0075	0.0079	0.0154	0.0096	0.0097	0.0162
0.0076	0.0080	0.0156	0.0097	0.0098	0.0164
0.0077	0.0081	0.0158	0.0098	0.0099	0.0166
0.0078	0.0082	0.0160	0.0099	0.0100	0.0168
0.0079	0.0083	0.0162	0.0100	0.0101	0.0170
0.0080	0.0084	0.0164	0.0101	0.0102	0.0172
0.0081	0.0085	0.0166	0.0102	0.0103	0.0174
0.0082	0.0086	0.0168	0.0103	0.0104	0.0176
0.0083	0.0087	0.0170	0.0104	0.0105	0.0178
0.0084	0.0088	0.0172	0.0105	0.0106	0.0180
0.0085	0.0089	0.0174	0.0106	0.0107	0.0182
0.0086	0.0090	0.0176	0.0107	0.0108	0.0184
0.0087	0.0091	0.0178	0.0108	0.0109	0.0186
0.0088	0.0092	0.0180	0.0109	0.0110	0.0188
0.0089	0.0093	0.0182	0.0110	0.0111	0.0190
0.0090	0.0094	0.0184	0.0111	0.0112	0.0192
0.0091	0.0095	0.0186	0.0112	0.0113	0.0194
0.0092	0.0096	0.0188	0.0113	0.0114	0.0196
0.0093	0.0097	0.0190	0.0114	0.0115	0.0198
0.0094	0.0098	0.0192	0.0115	0.0116	0.0200
0.0095	0.0099	0.0194	0.0116	0.0117	0.0202
0.0096	0.0100	0.0196	0.0117	0.0118	0.0204
0.0097	0.0101	0.0198	0.0118	0.0119	0.0206
0.0098	0.0102	0.0200	0.0119	0.0120	0.0208
0.0099	0.0103	0.0202	0.0120	0.0121	0.0210
0.0100	0.0104	0.0204	0.0121	0.0122	0.0212
0.0101	0.0105	0.0206	0.0122	0.0123	0.0214
0.0102	0.0106	0.0208	0.0123	0.0124	0.0216
0.0103	0.0107	0.0210	0.0124	0.0125	0.0218
0.0104	0.0108	0.0212	0.0125	0.0126	0.0220
0.0105	0.0109	0.0214	0.0126	0.0127	0.0222
0.0106	0.0110	0.0216	0.0127	0.0128	0.0224
0.0107	0.0111	0.0218	0.0128	0.0129	0.0226
0.0108	0.0112	0.0220	0.0129	0.0130	0.0228
0.0109	0.0113	0.0222	0.0130	0.0131	0.0230
0.0110	0.0114	0.0224	0.0131	0.0132	0.0232
0.0111	0.0115	0.0226	0.0132	0.0133	0.0234
0.0112	0.0116	0.0228	0.0133	0.0134	0.0236
0.0113	0.0117	0.0230	0.0134	0.0135	0.0238
0.0114	0.0118	0.0232	0.0135	0.0136	0.0240
0.0115	0.0119	0.0234	0.0136	0.0137	0.0242
0.0116	0.0120	0.0236	0.0137	0.0138	0.0244
0.0117	0.0121	0.0238	0.0138	0.0139	0.0246
0.0118	0.0122	0.0240	0.0139	0.0140	0.0248
0.0119	0.0123	0.0242	0.0140	0.0141	0.0250
0.0120	0.0124	0.0244	0.0141	0.0142	0.0252
0.0121	0.0125	0.0246	0.0142	0.0143	0.0254
0.0122	0.0126	0.0248	0.0143	0.0144	0.0256
0.0123	0.0127	0.0250	0.0144	0.0145	0.0258
0.0124	0.0128	0.0252	0.0145	0.0146	0.0260
0.0125	0.0129	0.0254	0.0146	0.0147	0.0262
0.0126	0.0130	0.0256	0.0147	0.0148	0.0264
0.0127	0.0131	0.0258	0.0148	0.0149	0.0266
0.0128	0.0132	0.0260	0.0149	0.0150	0.0268
0.0129	0.0133	0.0262	0.0150	0.0151	0.0270
0.0130	0.0134	0.0264	0.0151	0.0152	0.0272
0.0131	0.0135	0.0266	0.0152	0.0153	0.0274
0.0132	0.0136	0.0268	0.0153	0.0154	0.0276
0.0133	0.0137	0.0270	0.0154	0.0155	0.0278
0.0134	0.0138	0.0272	0.0155	0.0156	0.0280
0.0135	0.0139	0.0274	0.0156	0.0157	0.0282
0.0136	0.0140	0.0276	0.0157	0.0158	0.0284
0.0137	0.0141	0.0278	0.0158	0.0159	0.0286
0.0138	0.0142	0.0280	0.0159	0.0160	0.0288
0.0139	0.0143	0.0282	0.0160	0.0161	0.0290
0.0140	0.0144	0.0284	0.0161	0.0162	0.0292
0.0141	0.0145	0.0286	0.0162	0.0163	0.0294
0.0142	0.0146	0.0288	0.0163	0.0164	0.0296
0.0143	0.0147	0.0290	0.0164	0.0165	0.0298
0.0144	0.0148	0.0292	0.0165	0.0166	0.0300
0.0145	0.0149	0.0294	0.0166	0.0167	0.0302
0.0146	0.0150	0.0296	0.0167	0.0168	0.0304
0.0147	0.0151	0.0298	0.0168	0.0169	0.0306
0.0148	0.0152	0.0300	0.0169	0.0170	0.0308
0.0149	0.0153	0.0302	0.0170	0.0171	0.0310
0.0150	0.0154	0.0304	0.0171	0.0172	0.0312
0.0151	0.0155	0.0306	0.0172	0.0173	0.0314
0.0152	0.0156	0.0308	0.0173	0.0174	0.0316
0.0153	0.0157	0.0310	0.0174	0.0175	0.0318
0.0154	0.0158	0.0312	0.0175	0.0176	0.0320
0.0155	0.0159	0.0314	0.0176	0.0177	0.0322
0.0156	0.0160	0.0316	0.0177	0.0178	0.0324
0.0157	0.0161	0.0318	0.0178	0.0179	0.0326
0.0158	0.0162	0.0320	0.0179	0.0180	0.0328
0.0159	0.0163	0.0322	0.0180	0.0181	0.0330
0.0160	0.0164	0.0324	0.0181	0.0182	0.0332
0.0161	0.0165	0.0326	0.0182	0.0183	0.0334
0.0162	0.0166	0.0328	0.0183	0.0184	0.0336
0.0163	0.0167	0.0330	0.0184	0.0185	0.0338
0.0164	0.0168	0.0332	0.0185	0.0186	0.0340
0.0165	0.0169	0.0334	0.0186	0.0187	0.0342
0.0166	0.0170	0.0336	0.0187	0.0188	0.0344
0.0167	0.0171	0.0338	0.0188	0.0189	0.0346
0.0168	0.0172	0.0340	0.0189	0.0190	0.0348
0.0169	0.0173	0.0342	0.0190	0.0191	0.0350
0.0170	0.0174	0.0344	0.0191	0.0192	0.0352
0.0171	0.0175	0.0346	0.0192	0.0193	0.0354
0.0172	0.0176	0.0348	0.0193	0.0194	0.0356
0.0173	0.0177	0.0350	0.0194	0.0195	0.0358
0.0174	0.0178	0.0352	0.0195	0.0196	0.0360
0.0175	0.0179	0.0354	0.0196	0.0197	0.0362
0.0176	0.0180	0.0356	0.0197	0.0198	0.0364
0.0177	0.0181	0.0358	0.0198	0.0199	0.0366
0.0178	0.0182	0.0360	0.0199	0.0200	0.0368
0.0179	0.0183	0.0362	0.0200	0.0201	0.0370
0.0180	0.0184	0.0364	0.0201	0.0202	0.0372
0.0181	0.0185	0.0366	0.0202	0.0203	0.0374
0.0182	0.0186	0.0368	0.0203	0.0204	0.0376
0.0183	0.0187	0.0370	0.0204	0.0205	0.0378
0.0184	0.0188	0.0372	0.0205	0.0206	0.0380
0.0185	0.0189	0.0374	0.0206	0.0207	0.0382

repair construction, three factors were considered: (1) relative importance (or mix) of the individual types of construction activity; (2) differential price movements of the inputs; and (3) the impact of all other factors.

As we have noted above, each type of construction activity is characterized by its own set of input coefficients, which may differ from those used in other types of construction. Therefore, shifts in the mix of individual types of construction from one period to another can affect the direct requirements for total construction. For ex-

ample, residential construction requires more lumber and less asphalt per dollar of construction than does highway construction. If highway construction increases more rapidly than residential construction, the input pattern for total new construction will display a growing need for asphalt relative to the need for lumber.⁷

Differential movements in the prices of the material, service, and value-added costs of construction may lead to

⁷ As noted below, the information on individual types of construction is not detailed enough to account for all mix effects.

changes in input coefficients. For example, if the price of lumber does not keep pace with the prices of all other construction inputs, the relative importance of lumber inputs may change. Whether the lumber coefficient will increase, decrease, or not change at all depends on the extent of the price change and its effects on the consumption of lumber and other inputs. It is important to note that shifts in consumption induced by price changes are included in the third category.

The two elements of change so far discussed do not account for the total change observed in input patterns. The third component of change is a residual that represents the combined impact of changes over the 11-year period from such influences as the characteristics of construction facilities (e.g., the trend toward more bathrooms per house); architectural and engineering design (e.g., the greater use of cloverleaves and overpasses in highways); the increased use of machinery and improved methods of operation; and the use of prefabricated components and new materials (e.g., metal windows, plastic pipe). In addition, this residual category includes effects of the substitution of one input for another because of differential price movements; effects of economies of large-scale operation; the interaction of the factors; and the statistical errors associated with the estimates.

Measurement of components

The total change between the 2 years represents the difference in the 1947 direct requirements in 1947 prices and the 1958 requirements in 1958 prices, with 1947 as the base of the change. The measurement of the three components of change may be summarized as follows. The change in direct requirements due to mix was calculated

Table 4. Direct Requirements, 1947 and 1958, Per Dollar of Total New Construction, and Components of Change

Producing industry	1 1947 direct requirements in 1947 dollars	2 1958 direct requirements in 1958 dollars	3 Total change 1947-58	Components of change		
				Mix	Price	All other ¹
2. Other agricultural products.....	0.00273	0.00462	0.00189	-0.00032	-0.00040	0.00261
9. Stone and clay mining and quarrying.....	0.11110	0.11183	0.00074	0.00288	-0.00241	0.00067
12. Maintenance and repair construction.....	0.00229	0.00019	-0.00210	0.00041	-0.00005	-0.00111
13. Ordnance and accessories.....	0.00002	0.00010	0.00008	0	0.00001	0.00007
14. Food and kindred products.....	0.00007	0.00032	0.00025	0	0.00001	0.00024
17. Miscellaneous textile goods and floor coverings.....	0.01187	0.00897	-0.00290	-0.00117	-0.00133	0
18. Miscellaneous fabricated textile products.....	0.00003	0.00001	-0.00002	0.00001	0.00002	-0.00004
20. Lumber and wood products, except containers.....	0.01104	0.00228	-0.00876	-0.01320	-0.01311	-0.00209
22. Household furniture.....	0.00225	0.00598	0.00373	-0.00094	-0.00079	0.00214
24. Paper and allied products, except containers.....	0.00428	0.00817	0.00389	-0.00044	-0.00004	0.00297
27. Chemicals and selected chemical products.....	0.01139	0.00700	-0.00439	0.00006	-0.00011	0.00467
28. Paints and allied products.....	0.00229	0.00375	0.00146	-0.00087	-0.00138	-0.00224
31. Petroleum refining and related industries.....	0.01304	0.01822	0.00518	0.00112	-0.00205	0.00414
32. Rubber and miscellaneous plastics products.....	0.00253	0.00254	0.00001	0.00054	0.00072	0.00222
33. Glass and glass products.....	0.00331	0.00143	-0.00188	0.00025	0.00007	-0.00211
35. Stone and clay products.....	0.04482	0.07783	0.03301	-0.00127	0.00344	0.02117
37. Primary iron and steel manufacturing.....	0.03195	0.04246	0.01051	-0.00247	0.00221	0.00224
38. Primary nonferrous metal manufacturing.....	0.02844	0.04468	0.01624	-0.00227	0.00295	0.00653
40. Heating, plumbing, and structural metal products.....	0.01220	0.00906	-0.00314	0.00281	-0.00488	0.01993
41. Stampings, screw machine products, and bolts.....	0.00708	0.01143	0.00435	0.00016	0.00056	0.00221
42. Other fabricated metal products.....	0.01820	0.01658	-0.00162	-0.00200	0.00180	-0.00161
44. Farm machinery and equipment.....	0.00034	0.00006	-0.00028	-0.00025	-0.00016	-0.00049
45. Construction, mining, and oil field machinery.....	0.00386	0.00375	-0.00011	0.00099	0.00070	-0.00224
46. Material handling machinery and equipment.....	0.00362	0.00477	0.00115	0.00069	0.00132	0.00070
48. General industrial machinery and equipment.....	0.00379	0.00321	-0.00058	-0.00096	-0.00043	0.00371
50. Machine shop products.....	0.00006	0.00006	0	0.00002	0.00011	-0.00013
52. Service industry machines.....	0.00175	0.00174	-0.00001	0	0.00007	0.00020
53. Electric industrial equipment and apparatus.....	0.00215	0.00340	0.00125	-0.00023	0.00067	0.00059
54. Household appliances.....	0.00143	0.00282	0.00139	-0.00003	0.00256	0.00042
56. Electric lighting and wiring equipment.....	0.01168	0.01517	0.00349	0.00138	0.00248	0.00222
58. Radio, television, and communication equipment.....	0.00097	0.00070	-0.00027	-0.00014	-0.00004	0.00023
59. Miscellaneous electrical machinery, equipment, and supplies.....	0.00306	0.00258	-0.00048	-0.00004	0.00021	0.00006
60. Motor vehicles and equipment.....	0.00124	0.00082	-0.00042	0.00021	0.00056	-0.00057
61. Other transportation equipment.....	0.00004	0.00005	0.00001	0.00003	0	0.00001
62. Scientific and controlling instruments.....	0.00489	0.00465	-0.00024	-0.00043	-0.00048	0.00029
64. Miscellaneous manufacturing.....	0.01124	0.01150	0.00026	-0.00006	-0.00035	0.00045
65. Transportation and warehousing.....	0.00708	0.00443	-0.00265	-0.00005	-0.00050	-0.00011
66. Communications, except radio and television broadcasting.....	0.00124	0.00207	0.00083	0.00006	-0.00030	0.00067
68. Electric, gas, water and sanitary services.....	0.00304	0.00289	-0.00015	0.00003	-0.00003	0.00213
69. Wholesale and retail trade.....	0.00222	0.00407	0.00185	-0.00004	-0.00028	0.00207
70. Finance and insurance.....	0.01560	0.00830	-0.00730	0.00100	-0.00223	-0.00406
71. Real estate and rental.....	0.00231	0.00400	0.00169	-0.00006	-0.00017	0.00194
73. Automobile repair and services.....	0.00207	0.00603	0.00396	0.00051	-0.00143	-0.00787
77. Medical, educational services, and nonprofit organizations.....	0.01574	0.01111	-0.00463	0.00178	-0.01489	-0.00123
Average without regard to sign (unweighted).....	0.01281	0.01332	0.00051	0.00123	0.00208	0.00382
Average with regard to sign (unweighted).....	0.01281	0.01332	0.00051	-0.00025	-0.00069	0.00145

1. This is a residual category that represents the combined impact of changes from such influences as characteristics of construction facilities, architectural and engineering design, increased use of machinery and improved methods of operation, use of prefabricated components and new materials, effects of the substitution of one input for another because of differential price movements, effects of economies of large-scale operation, interaction of the factors, and statistical errors associated with the estimates.

NOTE.—Due to data limitations, 9 industries having 1958 inputs were not included in this comparison.

SOURCE: U.S. Department of Commerce, Office of Business Economics.

Computations of Components of Change

- 1947 direct requirements in 1947 prices
- 1958 direct requirements in 1958 prices
- 1947 direct requirements in 1947 prices weighted by 1958 types of construction
- 1947 direct requirements in 1958 prices weighted by 1947 types of construction

Total change.....	B - A = 1
Mix.....	C - A = 2
Price.....	D - A = 3
All other.....	1 - (2+3)

Table 5.—Total Change and Components of Change in Direct Input Coefficients of Total New Construction, for 12 Major Construction Materials

(Percent change, 1947 to 1958)

Producing Industry	Total	Mix	Price	All other ¹
Stone and clay mining and quarrying	7	24	-22	5
Lumber and wood products, except containers	-31	-16	-14	-9
Paper and allied products, except containers	44	-10	-16	69
Paints and allied products	-55	-10	-17	-28
Petroleum refining and related industries	33	23	-15	39
Glass and glass products	-51	3	2	-61
Stone and clay products	49	-2	7	36
Primary iron and steel manufacturing	38	-8	48	-7
Primary nonferrous metal manufacturing	-42	-8	-10	-24
Heating, plumbing, and structural metal products	22	3	-6	25
Other fabricated metal products	-9	-11	10	-6
Electric lighting and wiring equipment	30	12	21	-3

¹ See footnote 1, table 4.

NOTE.—Calculated by dividing the total change and each component of change (shown in table 4) by the 1947 coefficient.

Source: U.S. Department of Commerce, Office of Business Economics.

as the difference between the 1947 direct requirements in 1947 prices, weighted by the 1958 types of construction—and the 1947 direct requirements in 1947 prices. The change in direct requirements due to price was calculated as the difference between the 1947 direct requirements in 1958 prices, weighted by the 1947 types of construction—and the 1947 direct requirements in 1947 prices. Finally, all other changes were the residual of the total change less the mix and the price changes.

Because of statistical limitations, caution should be exercised in comparing the construction inputs of the 2 years. First, there are shortcomings in the indexes used to convert the 1947 construction data to 1958 prices.⁵

Second, there were statistical prob-

lems associated with placing the 1947 data on a basis comparable with the 1958 estimates.⁶

New construction

Table 4 shows for both 1947 and 1958 the direct requirements from each of the industries per dollar of total new construction and the change over the period. This change is further separated into each of the three components noted above: shifts in the mix of individual types of construction, differential price movements, and the residual of all other factors.

Certain of the changes shown in table 4 may reflect primarily the inadequacy of the statistics. The inputs of several materials were very small and were generally less reliable

than those for the more important construction materials. In addition, as noted above, the 1947-58 change for some of these less important materials reflects the deliberate squeezing of supply and service inputs in the 1947 study due to the understatement in the levels of construction and an inability to adjust for this problem. For these reasons, the analysis of change from 1947 to 1958 has been confined to the major materials, those whose direct requirements generally accounted for at least 1 percent of the value of total new construction.¹⁰ The

¹⁰ Paper, paint, and glass were also included in this category, although their inputs were less than the 1-percent minimum. It should be noted that the paint on plumbing fixtures, which is applied by the manufacturer, and the glass in preframed windows are classified as indirect requirements of these materials.

Table 6.—Direct Requirements, 1947 and 1958, Per Dollar of Total Maintenance and Repair Construction, and Components of Change

Producing Industry	1 1947 direct requirements in 1947 dollars	2 1958 direct requirements in 1958 dollars	3 Total change 1947-58	Components of change		
				Mix	Price	All other ¹
9. Stone and clay mining and quarrying	0.0018	0.0077	-0.0041	0.00027	-0.00278	0.00410
13. Maintenance and repair construction	0.0012	0.0036	-0.0006	0.0001	-0.0004	-0.0003
17. Miscellaneous textile goods and floor coverings	0.0117	0.0096	-0.0111	0.0004	-0.0038	-0.0025
19. Miscellaneous fabricated textile products	0.0002	0.0004	0.0002	0	-0.0001	0.0003
20. Lumber and wood products, except containers	0.0341	0.0278	-0.0266	-0.0038	-0.0403	-0.0074
24. Paper and allied products, except containers	0.0338	0.0494	-0.0332	0.0003	-0.0349	-0.0082
27. Chemicals and selected chemical products	0.0217	0.0419	0.0232	0.0006	-0.0139	0.0331
28. Paints and allied products	0.0478	0.0221	0.0533	0.0100	-0.0198	0.0320
31. Petroleum refining and related industries	0.0328	0.0222	-0.0101	0.0071	-0.0091	-0.0039
32. Rubber and miscellaneous plastics products	0.0198	0.031	0.0223	0.0023	0.0012	0.0190
35. Glass and glass products	0.0309	0.0493	0.0474	0.0020	-0.0046	0.0220
36. Stone and clay products	0.0406	0.0247	0.0159	0.0103	-0.0108	0.0167
37. Primary iron and steel manufacturing	0.0123	0.0122	-0.0011	-0.0048	0.0076	-0.0029
38. Primary nonferrous metal manufacturing	0.0121	0.0108	0.0027	0.0078	0.0026	0.0023
40. Heating, plumbing, and structural metal products	0.0130	0.0223	0.0237	0.0018	0.0207	0.0119
41. Stamping, screw machine products, and belts	0.0076	0.0124	0.0048	0.0007	0.0040	0.0004
42. Other fabricated metal products	0.0193	0.0309	-0.0184	-0.0241	-0.0047	-0.0076
43. Construction, mining, and oil field machinery	0.0181	0.0128	-0.0056	0.0038	0.0021	-0.0114
46. Materials handling machinery and equipment	0.0042	0.0049	0.0007	0.0007	0.0002	0.0002
49. General industrial machinery and equipment	0.0226	0.0113	-0.0113	-0.0018	-0.0048	-0.0009
50. Machine shop products	0.0004	0.0002	-0.0002	0.0001	0.0001	0.0000
52. Service industry machines	0.0001	0.0029	0.0028	-0.0001	0.0023	0.0036
53. Electric industrial equipment and apparatus	0.0056	0.0037	-0.0019	0.0002	-0.0006	0.0042
54. Household appliances	0.0118	0.0084	0.0035	0.0012	0.0017	0.0006
55. Electric lighting and wiring equipment	0.0299	0.0220	-0.0079	0.0000	0.0020	0.0059
56. Radio, television and communication equipment	0.0043	0.0128	0.0025	-0.0110	-0.0005	0.0040
58. Miscellaneous electrical machinery, equipment and supplies	0.0060	0.0029	-0.0001	-0.0016	0.0027	0.0012
59. Motor vehicles and equipment	0.0063	0.0001	-0.0062	0.0014	-0.0036	-0.0004
62. Scientific and controlling instruments	0.0013	0.0004	0.0001	0.0004	0.0001	0.0007
64. Miscellaneous manufacturing	0.0096	0.0087	0.0019	0.0002	0.0003	0.0014
65. Transportation and warehousing	0.0330	0.0150	-0.0184	-0.0080	-0.0075	-0.0029
66. Communications, except radio and television broadcasting	0.0003	0.0017	0.0024	0.0006	-0.0028	0.0044
68. Electric, gas, water, and sanitary services	0.0035	0.0145	0.0093	0.0004	-0.0024	0.0113
69. Wholesale and retail trade	0.0234	0.0170	-0.0064	0.0047	-0.0089	-0.0012
70. Finance and insurance	0.0073	0.0029	-0.0041	0.0078	0.0018	0.0081
71. Real estate and rental	0.0148	0.0087	-0.0069	0.0008	-0.0030	0.0081
72. Automobile repair and services	0.0068	0.0033	-0.0075	0.0045	-0.0026	-0.0086
Average without regard to sign (unweighted)	0.0133	0.0125	0.0035	0.0077	0.0037	0.0043
Average with regard to sign (unweighted)	0.0133	0.0125	0.0036	-0.0010	-0.0029	0.0047

1. This is a residual category that represents the combined impact of changes from such influences as characteristics of construction facilities, architectural and engineering design, increased use of machinery and improved methods of operation, use of prefabricated components and new materials, effects of the substitution on one input for another because of differential price movements, effects of economies of large-scale operation, interaction of the factors, and statistical errors associated with the estimates.

NOTE.—Due to data limitations, 10 industries having 1958 inputs were not included in this comparison.

Source: U.S. Department of Commerce, Office of Business Economics.

12 materials in this group accounted for 58 percent of the inputs of all materials and services used in new construction in 1958.

Table 5 shows for the 12 major materials the percent change from 1947 to 1958 in the direct input coefficients and the 3 components of the change. Direct coefficients for 2 of the 12 major materials changed by less than 10 percent, 8 by 20 to 50 percent, and 2 by slightly more than 50 percent. Differences in direct requirements for each of the major materials were attributable to all three of the components.

Shifts from 1947 to 1958 in the mix of selected categories of new construction are shown below. This list reveals that nonresidential buildings, military facilities, and highway construction increased in relative importance while nonfarm residential and public utilities decreased.

Percent of Total New Construction ¹

	1947	1958
Residential buildings (nonfarm).....	47	40
Nonresidential buildings.....	19	26
Public utilities.....	12	9
Military facilities.....	1	3
Highways.....	5	11

¹ Percentages are based on constant dollar data.

The effects of the change in mix were most pronounced in the case of the products of stone and clay mining and quarrying and refined petroleum products. With the increased importance of highway construction, both groups of products were more widely used. The increase in the use of glass, heating, plumbing, and structural metal products, and electric lighting and wiring equipment stemmed from the greater importance of nonresidential buildings, the effects of which more than offset the relative decrease in homebuilding. The relative decline in the use of lumber, paper, paint, and stone and clay products was associated with the relative decline in residential construction. The decreased importance of iron and steel and nonferrous metals was also a result of the relative decline of residential construction, as well as of public utility construction.

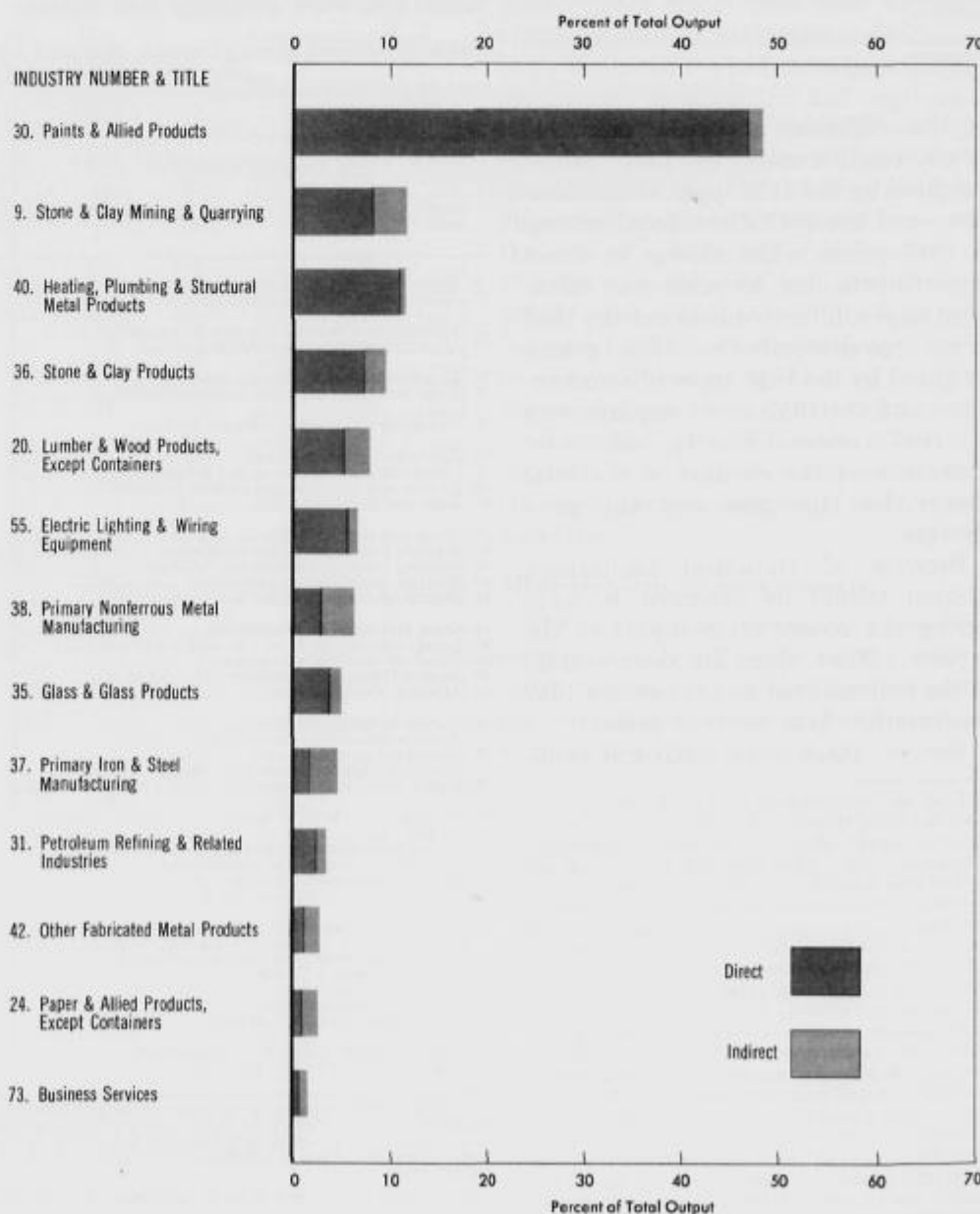
As indicated in table 5, the 1947-58 change in the residual category was less than 10 percent for five materials, between 20 and 40 percent for another five materials, and between 60 and 70 percent for two materials. This last

category consisted of paper products, which showed the largest increase, and glass, which had the largest decrease. The decline in the direct requirements for glass may be attributable to the increased use of prefabricated windows. Consequently, glass appears now as a more important indirect requirement.

Most of the change in the residual appears to be related to changes in the characteristics of construction facilities, product developments leading to prefabricated components and new ma-

terials, and increased use of machinery and improved methods of operating by the construction industry. Changes in the characteristics of construction facilities are an element of mix that could not be accounted for in the mix component, given the degree of detail available for individual types of construction. The increased use of machinery may have reduced material wastage, increased the consumption of fuels and electric power, and altered the value-added share of construction costs.

Importance of Maintenance and Repair Construction in Generating Output in Selected Industries, 1958



Maintenance and repair construction

The material and service inputs per dollar of total maintenance and repair construction in 1947 and 1958 are compared in table 6. Percent changes in the coefficients, as well as the components of change, are shown in table 7 for the 12 major materials. These 12 accounted for 63 percent of all material and service inputs of maintenance and repair construction in 1958.

Table 7 indicates that changes in the input coefficients due to shifts in the mix of individual types of maintenance and repair construction were generally small. An exception was the coefficient for primary iron and steel products, which decreased by 21 percent. This was attributable largely to the decline in the relative importance of maintenance and repair of railroads and local transit facilities.

The effect of differential price change was fairly large for most major materials. Relative prices declined for 10 of the materials and increased for only 2. The predominance of these decreases reflected the fact that wage costs rose more than the prices of materials used in maintenance and repair.

The residual component of change was large in most cases. Five of the major materials had changes of less than 15 percent, four had changes of 25 to 49 percent, and three had changes of 50 to 80 percent. A significant element in the large residual change was the decreased importance of major replacements in maintenance and repair from 1947 to 1958. These replacements use more materials per dollar than are used in ordinary maintenance and repair.¹¹

Evaluation of the Changes of the Construction Inputs

The foregoing analysis indicates that changes in the mix of individual types of construction, in relative prices, and in "all other" factors resulted in substantial changes over time in the

direct material and service requirements for construction. In many cases, the effects of these component changes were offsetting; thus, the overall change was somewhat smaller than the component changes.

The occurrence of large changes is not surprising in view of the 11-year lapse between the two input-output studies. Undoubtedly, the changes in direct requirements were in some measure due to the abnormal circumstances of the early postwar period. One would expect smaller changes in direct requirements to occur over other time periods of equal length. Nevertheless, for years other than 1958, it will probably still be necessary to adjust the 1958 direct requirements for changes in the mix of construction and for "all other" factors.

The basic data needed to adjust for major changes in the mix of construction are provided by the detailed inputs for separate types of construction presented in this article and by the detailed statistics that are regularly published for the various types of construction expenditures. As noted earlier, price indexes are available for the important types of new construction. It will be more difficult to adjust for changes in the "all other" component. Some modifications, on a judgmental basis, however, can be made for the more significant changes in the characteristics of individual types of construction. For example, changes in the regional distribution of housing starts, the increasing number of bathrooms per dwelling unit, and the growing importance of central air conditioning are significant factors affecting the types of materials used in residential construction. Other examples of developments which may affect the construction inputs are the greater use of concrete and asphalt surfacing instead of gravel and macadam in highway construction, and the shift in telephone construction from overhead to underground lines. Among product developments that may be inducing changes in input coefficients, there is an increasing use of prefabricated metal windows. Prefabricated partitions and wall and ceiling panels are becoming more widely used, and there is a continuing shift from plaster to wallboard.

There is, however, a limit to the

extent one can rely on piecemeal adjustments to adapt the direct requirements of a given year to another time period. Furthermore, this alternative is not feasible for the adjustment of the indirect and thus total requirements of construction. The periodic preparation of new input-output tables is essential for providing the necessary data. Such tables will be prepared by OBE for each year covered by the major economic censuses, with at least one updated table for an intercensal year.

Appendix

The value of new and maintenance and repair construction includes the value-put-in-place of all private and public construction. The measure is defined on an activity basis and thereby covers all construction regardless of who performed the work. It includes work done on contract as well as work done by government agencies and non-construction firms with their own (force account) employees, and the value of materials used in residential and farm construction performed by households on a do-it-yourself basis.

Materials, payrolls, profits, overhead, architectural, engineering, and demolition costs directly associated with the construction project are part of value-put-in-place. Value-put-in-place refers

Table 7.—Total Change and Components of Change in Direct Input Coefficients of Total Maintenance and Repair Construction, for 12 Major Construction Materials

Producing industry	(Percent change, 1947 to 1958)			
	Total	Mix	Price adjustment	All other
Stone and clay mining and quarrying.....	-15	3	-30	12
Lumber and wood products, except containers.....	-54	-12	-28	-14
Paper and allied products, except containers.....	-52	1	-43	-10
Prints and allied products.....	11	2	-30	39
Petroleum refining and related industries.....	-31	8	-27	-12
Glass and glass products.....	50	0	-16	66
Stone and clay products.....	71	3	-0	77
Primary iron and steel manufacturing.....	-24	-21	33	-28
Primary nonferrous metals manufacturing.....	34	0	-1	29
Heating, plumbing, and structural metal products.....	-30	2	-34	-14
Other fabricated metal products.....	-34	-12	-23	-47
Electric lighting and wiring equipment.....	-44	5	2	-53

¹ See footnote 1, table 6.

Note.—Calculated by dividing the total change and each component of change (shown in table 6) by the 1947 coefficient.

Source: U.S. Department of Commerce, Office of Business Economics.

¹¹ For example, the replacement share of residential maintenance and repair construction was approximately 35 percent in 1947 and 25 percent in 1958. The shift from major replacements in 1947 to less extensive maintenance and repair in 1958 was a consequence of the disappearance of the abnormal conditions of the immediate postwar period. This shift is an element of mix which could not be accounted for in the mix component because of insufficient detail.

to work done during a given time period regardless of the starting and completion date of the entire construction project. For the present study, only that part of a project worked on during calendar year 1958 is included.

The separation between private and public construction, and within the public category, between Federal construction and State and local construction, is based on ownership, not on the source of financing. Privately owned facilities receiving government grants, loans, and insurance for construction are classified under private construction. State-owned and locally-owned facilities receiving Federal grants are classified under State and local construction.

Equipment that is an integral part of the facility and essential for its general use is included in the value of construction. Some examples are elevators, heating, plumbing, and electrical fixtures. Equipment items that are not structurally part of the facility or that are meant for a special rather than for general use of the facility are not included in construction value. Examples are refrigerators and ranges, and fixed conveyor lines in factories.

New construction (industry 11) covers the original work, and additions and alterations that increase or alter the stock of facilities. It includes buildings and nonbuilding structures such as housing, schools, factories, highways, oil and gas well exploration and drilling, sewage and water systems and, in the case of business, other comparable outlays charged to capital account. The value of new construction work by construction contractors (SIC 15, 16, and 17), operative builders (part of SIC 6561), and establishments performing oil and gas field services (SIC 138) is included in new construction. Also included are oil and gas field services that are performed in the mining industries, force account construction done by government agencies and nonconstruction firms with their own employees, and manufacturers' receipts from the installation of construction-type equipment. The category also embraces the value

of materials of household do-it-yourself new construction.

Maintenance and repair construction (industry 12) covers the upkeep and restoration of existing facilities of the same sort specified under new construction. Oil and gas well drilling and exploration are excluded.

In the case of business, maintenance and repair costs are charged to current expense; government maintenance and repair is represented as a government purchase. The category includes the value of maintenance and repair work done by construction contractors (SIC 15, 16, and 17), the work performed by force account employees of government agencies and nonconstruction firms, as well as the value of materials used in household do-it-yourself maintenance and repair construction.

Data sources

The activity totals for new and maintenance and repair construction are based primarily on the value-put-in-place series prepared by the Bureau of the Census. The levels for new construction appeared in the Census publication *Value of New Construction Put in Place, 1946-63*, revised (C30-6 supplement). The levels for maintenance and repair construction for 1958 were presented in the October 1963 issue of *Construction Review*, and for 1947, in *Construction Volume and Costs, 1958*, publications of the Business and Defense Services Administration. The OBE estimate of oil and gas well drilling and exploration is added to the value-put-in-place total of new construction.

The only adjustments to these published data were in maintenance and repair construction. The most significant adjustment was a reduction in the value of residential maintenance and repair construction to correspond to the maintenance and repair expenses used in the national income estimate of rental income.

Estimates of each type of material and service used in total construction activity (new as well as maintenance

and repair) were derived from the distribution of output of each of the producing industries, developed in the compilation of the 1958 input-output table. Similarly, value added was obtained primarily as a composite for all construction, by using data on national income originating in the contract construction industries, supplemented by information from the Internal Revenue Service, Bureau of the Census, and other Government agencies.

Detailed estimates of materials, services, and the value added for each type of construction were based in part on construction expenditure studies of the Bureau of Labor Statistics, Bureau of the Census, Bureau of Public Roads, Business and Defense Services Administration, Veterans' Administration, Agricultural Marketing Service, Rural Electrification Administration, Forest Service, Bureau of Reclamation, Federal Reserve Board, McGraw-Hill Publishing Co., American Institute of Architects, National Society of Professional Engineers, Independent Petroleum Association of America, National Association of Home Builders, American Gas Association, Ebasco Services, Inc., and Foster Associates, Inc. Data were also obtained from a special survey of the costs of construction contractors conducted by the Bureau of the Census. Administrative reports of the Interstate Commerce Commission, Federal Power Commission, Federal Communications Commission, Corps of Engineers, and National Park Service and discussions with construction contractors were other major sources of data on inputs by type of construction.

Because of variations in the reliability of these sources, the inputs for only selected types of construction are published in this article. The published data are limited to estimates based on representative samples of construction projects showing specific material and value-added costs. Inputs for the unpublished types of construction, which are less reliable, are available upon request to the OBE.